

II. MODELING RESULTS

BASE CASE MODELING RESULTS

The results of the base case ground water simulations showed problem areas where the resource protection criteria were not met because the severity and/or duration of a water-level decline exceeded the resource protection criteria levels. Problem areas where resource protection criteria were exceeded occurred at both the 1990 permitted demand level and 2010 projected demand level. Some problem areas occurred under both 1-in-10 drought conditions and average rainfall conditions.

The modeling results showed that the area estimated to exceed the wetland protection criterion increased significantly from the 1990 permitted demand level to the 2010 projected demand level. There are approximately 558,000 acres of wetlands within the LWC Planning Area (447,000 acres in Collier County; 63,000 acres in Lee County; and 48,000 in the Hendry County Area). The wetland protection criterion was not met within the modeled portion of the LWC Planning Area for 50,000 acres of wetlands (9% of total wetlands) at the 1990 permitted demand level, and for 73,000 acres (13% of total wetlands) at the 2010 projected demand level (figures 2-7). It is important to note that the actual difference in potential wetland impacts between 1990 and 2010 may be considerably greater than the simulated differences due to the discrepancy, approximately 40 percent overall, between actual 1990 demands, based on planted acres, and modeled demands, based on permitted acres.

The seawater intrusion protection criterion was exceeded along portions of the coast in the water table and lower Tamiami aquifers in the base case model runs for both the 1990 permitted demand level and the 2010 projected demand level. However, there was not a large difference in the occurrences.

The general aquifer protection criterion was generally met in the base case model runs with the exception of small areas of the Sandstone aquifer in eastern Lee and western Hendry counties. There was only a minor difference in areas not meeting the general aquifer protection criterion between the 1990 permitted demand level and 2010 projected demand level. Figures 8 and 9 show the areas where the general aquifer protection criterion was not met in the Sandstone aquifer at the 2010 projected demand level.

ALTERNATIVE MODELING SCENARIO RESULTS

Alternative modeling scenarios 1a (remove all public water supplies from shallow aquifers), 1b (remove future public water supplies from shallow aquifers), and 3 (increase use of reclaimed water) involve urban water demand and reclaimed water. Urban water demand is only a very small portion of the total demand in Hendry County, and nearly all of the reclaimed water available in the LWC Planning Area occurs in Collier and Lee counties. Because of this, alternatives 1a, 1b, and 3 were not simulated for Hendry County. Alternative modeling scenarios 5a, 5b, 6a, and 6b include combinations with modeling scenarios 1a, 1b and 3; therefore, modeling scenarios 5a, 5b, 6a, and 6b were also not simulated for Hendry County.

Alternatives 2a, 2b, and 2c involve increases in agricultural efficiency; these three scenarios were simulated for Collier, Lee, and Hendry counties. Alternative modeling scenario 4 involved proposed modifications of the Big Cypress Basin canal

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system in Collier, and was only applicable to Collier County. Scenario 4 was not simulated for Lee and Hendry counties.

Scenario 1 - Evaluate reduction of public water supply demands from the shallow aquifers

Results for modeling scenario 1 are reported for Collier and Lee counties; however, since public water supply is such a relatively small component of total demand in Hendry County, modeling scenario 1 was not simulated for Hendry County. Two variations of scenario 1 were simulated: (1) scenario 1a, in which all public water supply demands were removed from the shallow aquifers, and (2) scenario 1b, in which only future public water supply demands were removed from the shallow aquifers.

Effectiveness for the Wetland Protection Criterion. Scenario 1a reduced wetland problem areas compared to the 2010 base case by 26 percent in Collier County and by 60 percent in Lee County. The reduction in wetland problem areas in Collier and Lee counties from scenario 1a yielded a 38 percent reduction in total wetland problem areas for the modeled portion of the LWC Planning Area. The modeled portion of the LWC Planning Area includes all of Lee County and those portions of Collier and Hendry counties that lie within the LWC planning Area. Figures 10 and 11 show the modeling results from scenario 1a for Collier and Lee counties, respectively.

Scenario 1b reduced wetland problem areas compared to the 2010 base case by 10 percent in Collier County and by 32 percent in Lee County. The reduction in wetland problem areas in Collier and Lee counties from scenario 1b yielded a 19 percent reduction in total wetland problem areas for the modeled portion of the LWC Planning Area. Figures 12 and 13 show the modeling results from scenario 1b for Collier and Lee counties, respectively.

Effectiveness for the Seawater Intrusion Protection Criterion. Scenario 1a reduced the relative index for the seawater intrusion criterion in the lower Tamiami aquifer compared to the 2010 base case by approximately 40 percent in both Collier and Lee counties. Scenario 1a also reduced the relative index for the seawater intrusion criterion in the water table aquifer by 27 percent and 1 percent in Collier County and Lee counties, respectively.

Scenario 1b reduced the relative index for seawater intrusion in the lower Tamiami aquifer by 9 percent and 5 percent for Collier County and Lee counties, respectively. Scenario 1b reduced the relative index for seawater intrusion in the water table aquifer by 27 percent in Collier County, but had no effect on the relative index for seawater intrusion in water table aquifer of Lee County.

Effectiveness for the General Aquifer Protection Criterion. The general aquifer protection criterion had been completely met in the base case model simulations for Collier County, and so scenario 1 simulations were not needed to achieve compliance with the general aquifer protection criterion in Collier County. Only a few cells in the layer representing the Sandstone aquifer of eastern Lee County and western Hendry County had failed to meet the general aquifer protection criterion. Scenario 1a caused a small improvement in meeting the general aquifer protection criterion for the Sandstone aquifer layer in Lee County. Scenario 1b did not yield any significant change in meeting the general aquifer protection criterion for Lee County. Scenarios 1a and 1b were not simulated for Hendry County.

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Scenario 2 - Evaluate reduction of agricultural water use by increased irrigation efficiency

Scenario 2 included three variations: (1) scenario 2a, improving the irrigation efficiency of small vegetables, (2) scenario 2b, improving the irrigation efficiency of citrus, and (3) scenario 2c, improving the irrigation efficiency of both small vegetable and citrus. The three variations of scenario 2 were primarily effective in reducing the total area that did not meet the wetland protection criterion. Scenarios 2a, 2b, and 2c had little effect on the relative index for the seawater intrusion or general aquifer protection criteria. Scenario 2c was more effective than either scenarios 2a or 2b in reducing wetland problem areas.

Effectiveness for the Wetland Protection Criterion. Scenario 2c (increasing the efficiency of both small vegetables and citrus) was, as expected, more effective in reducing wetland problem areas than either scenario 2a (improving the irrigation efficiency of small vegetables) or 2b (improving the irrigation efficiency of citrus). Scenario 2c caused an 8 percent reduction in total wetland problem areas for the modeled portion of the LWC Planning Area compared to the 2010 base case. Scenario 2c caused reductions in wetland problems areas of 11 percent and 7 percent for Collier and Lee counties, respectively. Scenario 2c did not yield any significant change in wetland problem areas within Hendry County. This may be due to several factors, including fewer acres of small vegetables in Hendry County. Also, many of the citrus orchards in Hendry County are relatively new and are permitted with relatively high efficiencies. Figures 14 and 15 show the modeling results from scenario 2c for Collier and Lee counties, respectively.

Scenario 2a (increasing the efficiency of small vegetables only) was only slightly less effective than scenario 2c, indicating that most of the effectiveness of scenario 2c in meeting the wetland protection criterion was due to increasing the efficiency for small vegetables. Scenario 2a caused a 7 percent reduction in total wetland problem areas for the modeled portion of the LWC Planning Area compared to the 2010 base case. Scenario 2c caused reductions in wetland problems areas of 10 percent and 5 percent for Collier and Lee counties, respectively. As was the case for scenario 2c, scenario 2a did not yield any significant change in wetland problem areas within Hendry County.

Scenario 2b (increasing the efficiency of citrus alone) only decreased wetland problem areas by 1 percent in Collier County and by 2 percent in Lee County compared to their respective 2010 base case model runs.

Although the variations of scenario 2 did provide some improvement in meeting the wetland protection criterion, they were not as effective as might be expected considering the relatively large irrigated area and associated irrigation demands. This is no doubt due in part to the simulated return of a portion (75%) of the irrigation inefficiency to the water table as recharge. Thus while increasing the irrigation efficiency causes a large reduction in the total ground water withdrawals, it also causes a reduction in recharge to the water table.

Effectiveness for the Seawater Intrusion Protection Criterion. The three variations of modeling scenario 2 had no significant effect in changing the relative index for the seawater intrusion criterion in either the lower Tamiami aquifer or the water table aquifer layers of Collier and Lee counties. The lack of effectiveness in improving the relative index for seawater intrusion from scenario 2 is interpreted to be related to the distribution of irrigated demands. Most of the irrigated demands are

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not located near the coast. These results suggest that only demands located near the coast are significant in causing seawater intrusion.

Effectiveness for the General Aquifer Protection Criterion. The general aquifer protection criterion had been completely met in the base case model simulations for Collier County, and so the three variations of scenario 2 did not need to be simulated to achieve compliance with the general aquifer protection criterion in Collier County. Only a few cells in the layer representing the Sandstone aquifer of eastern Lee County and western Hendry County had failed to meet the general aquifer protection criterion. The three variations of modeling scenario 2 had no significant effect in changing the relative index for the general aquifer protection criterion in the Sandstone aquifer of Lee and Hendry counties.

Scenario 3 - Evaluate increased use of reclaimed water

Scenario 3 assumed that all of the available supply of reclaimed water in the LWC Planning Area would be utilized to meet irrigation demands. The available supply of reclaimed water was defined as average of the three minimum flow months for each regional wastewater treatment plant in Lee County and the modeled portion of Collier County for the year 2010. This scenario was simulated by reducing well withdrawals and replacing them with reclaimed water.

Nearly all of the projected supply of reclaimed water in the LWC Planning Area is in Collier and Lee counties. Scenario 3 was not simulated in the Hendry County model because the projected reuse in Hendry County is insignificant.

Effectiveness for the Wetland Protection Criterion. Scenario 3 reduced wetland problem areas by 6 percent in Collier County and by 9 percent in Lee County compared to their respective 2010 base case runs. Scenario 3 reduced wetland problem areas for the modeled portion of the LWC Planning Area by 6 percent.

Effectiveness for the Seawater Intrusion Protection Criterion. Scenario 3 reduced the relative index for seawater intrusion in the lower Tamiami aquifer by 22 percent in Collier County and by 29 percent in Lee County compared to the 2010 base case. The improvement in the relative index for seawater intrusion in the Lower Tamiami aquifer was 24 percent for these two counties combined. Scenario 3 reduced the relative index for seawater intrusion in the water table aquifer of Lee County by 13 percent, but had no significant effect on the relative index for seawater intrusion in the water table aquifer of Collier County.

Effectiveness for the General Aquifer Protection Criterion. The general aquifer protection criterion had been completely met in the base case model simulations for Collier County, and so scenario 3 simulations were not needed to achieve compliance with the general aquifer protection criterion in Collier County. Only a few cells in the layer representing the Sandstone aquifer of eastern Lee County and western Hendry County had failed to meet the general aquifer protection criterion. Scenario 3 had no significant effect in changing the relative index for the general aquifer protection criterion in the Sandstone aquifer of Lee County. This is not especially surprising for two reasons: (1) the problem areas in the Sandstone aquifer are not near the areas where reuse is projected to occur, and (2) the increased use of reclaimed water is likely to mostly affect layers one and two of the model. The Sandstone aquifer is layer 3 of the model. Scenario 3 was not simulated for Hendry County, because there the potential supply of reclaimed water in Hendry County is so small.

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Scenario 4 - Evaluate implementation of proposed long-term modifications of the Big Cypress Basin canal system

All of the proposed long-term modifications of the Big Cypress Basin are in Collier County, so scenario 4 was not simulated with the models for Lee and Hendry counties. In general, scenario 4 affects only that portion of Collier County where the Big Cypress Basin canal system is located. Simulated modifications to this canal system included elimination of canals in the Golden Gate Estates South area and addition of control structures on the Miller and Faka Union canals directly north of Alligator Alley. Control elevations for the new structures were set at one foot below land surface to maintain higher water levels north of I-75.

Effectiveness for the Wetland Protection Criterion. Scenario 4 reduced the area in Collier County where wetlands did not meet the wetland protection criterion by 5 percent compared to the 2010 base case.

Effectiveness for the Seawater Intrusion Protection Criterion. Scenario 4 caused no significant reduction in the relative index for seawater intrusion in either the lower Tamiami or water table aquifers of Collier County.

Effectiveness for the General Aquifer Protection Criterion. The general aquifer protection criterion had been completely met in the base case model simulations for Collier County, and so scenario 4 simulations were not needed to achieve compliance with the general aquifer protection criterion in Collier County.

Scenario 5 - Evaluate combination of Scenarios 1 and 3

Modeling scenario 5 had two variations: (1) scenario 5a, which combined modeling scenario 1a (remove all public water supply from the shallow aquifers) with modeling scenario 3 (increase use of reclaimed water); and (2) scenario 5b, which combined modeling scenario 1b (remove future public water supplies from the shallow aquifers) with modeling scenario 3.

Modeling scenarios 1a, 1b, and 3 involved urban water supplies and reclaimed water, neither of which are very large in Hendry County. Scenarios 1a, 1b, and 3 were not simulated for Hendry County. Consequently, modeling scenarios 5a and 5b were also not modeled for Hendry County.

Effectiveness for the Wetland Protection Criterion. Scenario 5a reduced wetland problem areas in Collier County by 26 percent compared to the 2010 base case. Scenarios 1a and 3 had caused reductions of 26 percent and 6 percent, respectively, compared to the 2010 base case for Collier County. Scenario 5a reduced wetland problem areas in Lee County by 64 percent compared to the 2010 base case. Scenarios 1a and 3 had caused reductions of 60 percent and 9 percent, respectively, compared to the 2010 base case for Lee County.

Scenario 5b reduced wetland problem areas in Collier County by 13 percent compared the 2010 base case. Scenarios 1b and 3 had caused reductions of 10 percent and 6 percent, respectively, compared to the 2010 base case for Collier County. Scenario 5b reduced wetland problem areas in Lee County by 36 percent compared to the 2010 base case. Scenarios 1b and 3 had caused reductions of 32 percent and 9 percent, respectively, compared to the 2010 base case for Lee County.

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Effectiveness for the Seawater Intrusion Protection Criterion. Scenario 5a reduced the relative index for the seawater intrusion criterion in the lower Tamiami aquifer by 61 percent in Collier County and 73 percent in Lee County compared to their respective 2010 base case runs. Scenario 5a reduced the relative index for the seawater intrusion criterion in the lower Tamiami aquifer by 64 percent for Collier and Lee counties combined. Scenarios 1a and 3 had reduced the relative index for seawater intrusion in the lower Tamiami aquifer (for Collier and Lee counties combined) by 40 percent and 24 percent, respectively.

Scenario 5a reduced the relative index for the seawater intrusion criterion in the water table aquifer by 30 percent in Collier County and 13 percent in Lee County compared to their respective 2010 base case runs. Scenario 5a reduced the relative index for the seawater intrusion criterion in the water table aquifer by 17 percent for Collier and Lee counties combined. Scenarios 1a and 3 had reduced the relative index for seawater intrusion in the water table aquifer (for Collier and Lee counties combined) by 4 percent and 12 percent, respectively.

Scenario 5b reduced the relative index for the seawater intrusion criterion in the lower Tamiami aquifer by 37 percent in Collier County and 44 percent in Lee County compared to their respective 2010 base case runs. Scenario 5b reduced the relative index for the seawater intrusion criterion in the lower Tamiami aquifer by 39 percent for Collier and Lee counties combined. Scenarios 1b and 3 had reduced the relative index for seawater intrusion in the lower Tamiami aquifer (for Collier and Lee counties combined) by 8 percent and 24 percent, respectively.

Scenario 5b reduced the relative index for the seawater intrusion criterion in the water table aquifer by 27 percent in Collier County and 13 percent in Lee County compared to their respective 2010 base case runs. Scenario 5b reduced the relative index for the seawater intrusion criterion in the water table aquifer by 15 percent for Collier and Lee counties combined. Scenarios 1b and 3 had reduced the relative index for seawater intrusion in the water table aquifer (for Collier and Lee counties combined) by 3 percent and 12 percent, respectively.

Effectiveness for the General Aquifer Protection Criterion. The general aquifer protection criterion had been completely met in the base case model simulations for Collier County, and so scenario 5a and 5b simulations were not needed to achieve compliance with the general aquifer protection criterion in Collier County. Only a few cells in the layer representing the Sandstone aquifer of eastern Lee County and western Hendry County had failed to meet the general aquifer protection criterion. Scenario 5a caused a small improvement in meeting the general aquifer protection criterion for the Sandstone aquifer layer in Lee County. Scenario 5b did not yield any significant change in meeting the general aquifer protection criterion for Lee County. Alternatives 1a, 1b, and 3 were not simulated for Hendry County; consequently, the combination alternative modeling scenarios 5a and 5b could not be simulated for Hendry County.

Scenario 6 - Evaluate combination of Scenarios 1, 2c, and 3

Modeling scenario 6 had two variations: (1) scenario 6a, which combined modeling scenario 1a (remove all public water supply from the shallow aquifers), modeling scenario 2c (improving the irrigation efficiency of both small vegetables and citrus), and modeling scenario 3 (increase use of reclaimed water); and (2) scenario 6b, which combined modeling scenario 1b (remove future public water supplies from the shallow aquifers), modeling scenario 2c, and modeling scenario 3.

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Modeling scenarios 1a, 1b, and 3 involved urban water supplies and reclaimed water, neither of which are very large in Hendry County. Scenarios 1a, 1b, and 3 were not simulated for Hendry County. Similarly, modeling scenarios 6a and 6b were not modeled for Hendry County.

Effectiveness for the Wetland Protection Criterion. Scenario 6a reduced wetland problem areas in Collier County by 39 percent compared the 2010 base case. Scenarios 1a, 2c, and 3 had caused reductions of 26 percent, 11 percent, and 6 percent, respectively, compared to the 2010 base case for Collier County. Scenario 6a reduced wetland problem areas in Lee County by 70 percent compared to the 2010 base case. Scenarios 1a, 2c, and 3 had caused reductions of 60 percent, 7 percent, and 9 percent, respectively, compared to the 2010 base case for Lee County.

Scenario 6b reduced wetland problem areas in Collier County by 22 percent compared to the 2010 base case. Scenarios 1b, 2c, and 3 had caused reductions of 10 percent, 11 percent, and 6 percent, respectively, compared to the 2010 base case for Collier County. Scenario 6b reduced wetland problem areas in Lee County by 48 percent compared to the 2010 base case. Scenarios 1b, 2c, and 3 had caused reductions of 32 percent, 7 percent, and 9 percent, respectively, compared to the 2010 base case for Lee County.

Effectiveness for the Seawater Intrusion Protection Criterion. Scenario 6a reduced the relative index for the seawater intrusion criterion in the lower Tamiami aquifer by 69 percent in Collier County and 83 percent in Lee County compared to their respective 2010 base case runs. Scenario 6a reduced the relative index for the seawater intrusion criterion in the lower Tamiami aquifer by 72 percent for Collier and Lee counties combined. Scenarios 1a, 2c, and 3 had reduced the relative index for seawater intrusion in the lower Tamiami aquifer (for Collier and Lee counties combined) by 40 percent, 3 percent, and 24 percent, respectively.

Scenario 6a reduced the relative index for the seawater intrusion criterion in the water table aquifer by 47 percent in Collier County and 5 percent in Lee County compared to their respective 2010 base case runs. Scenario 6a reduced the relative index for the seawater intrusion criterion in the water table aquifer by 10 percent for Collier and Lee counties combined. Scenarios 1a, 2c, and 3 had reduced the relative index for seawater intrusion in the water table aquifer (for Collier and Lee counties combined) by 4 percent, 0 percent, and 12 percent, respectively.

Scenario 6b reduced the relative index for the seawater intrusion criterion in the lower Tamiami aquifer by 41 percent in Collier County and 56 percent in Lee County compared to their respective 2010 base case runs. Scenario 6b reduced the relative index for the seawater intrusion criterion in the lower Tamiami aquifer by 45 percent for Collier and Lee counties combined. Scenarios 1b, 2c, and 3 had reduced the relative index for seawater intrusion in the lower Tamiami aquifer (for Collier and Lee counties combined) by 8 percent, 3 percent, and 24 percent, respectively,

Scenario 6b reduced the relative index for the seawater intrusion criterion in the water table aquifer by 27 percent in Collier County and 4 percent in Lee County compared to their respective 2010 base case runs. Scenario 6b reduced the relative index for the seawater intrusion criterion in the water table aquifer by 7 percent for Collier and Lee counties combined. Scenarios 1b, 2c, and 3 had reduced the relative index for seawater intrusion in the water table aquifer (for Collier and Lee counties combined) by 3 percent, 0 percent, and 12 percent, respectively.

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Effectiveness for the General Aquifer Protection Criterion. The general aquifer protection criterion had been completely met in the base case model simulations for Collier County, and so scenario 6a and 6b simulations were not needed to achieve compliance with the general aquifer protection criterion in Collier County. Only a few cells in the layer representing the Sandstone aquifer of eastern Lee County and western Hendry County had failed to meet the general aquifer protection criterion. Scenarios 6a and 6b caused small improvements in meeting the general aquifer protection criterion for the Sandstone aquifer layer in Lee County. Alternatives 1a, 1b, and 3 were not simulated for Hendry County; consequently, the combination alternative modeling scenarios 6a and 6b could not be simulated for Hendry County.

1990 Base Case Versus 2010 Base Case

Figures 2 through 9

Wetland Areas with Criteria Exceeded

Frequency: 1 in 10 Rain, 1990 Base Case

Severity: > 1.0 ft drawdown

Duration: > 1 month

Acres: 27,280 (6.3 percent of total acres)

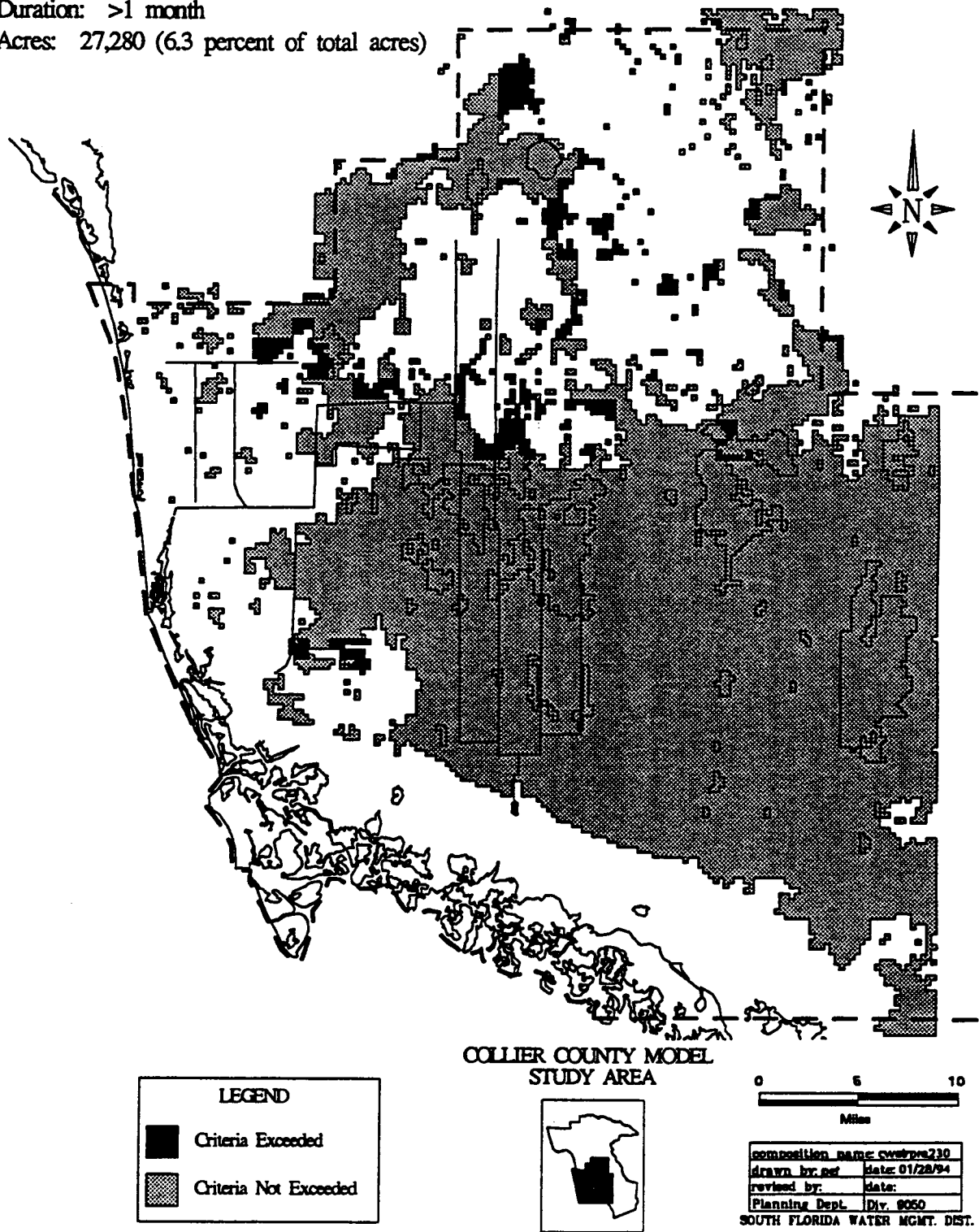


FIGURE 2. Collier County Model Wetlands Criteria, 1990 Base Case.

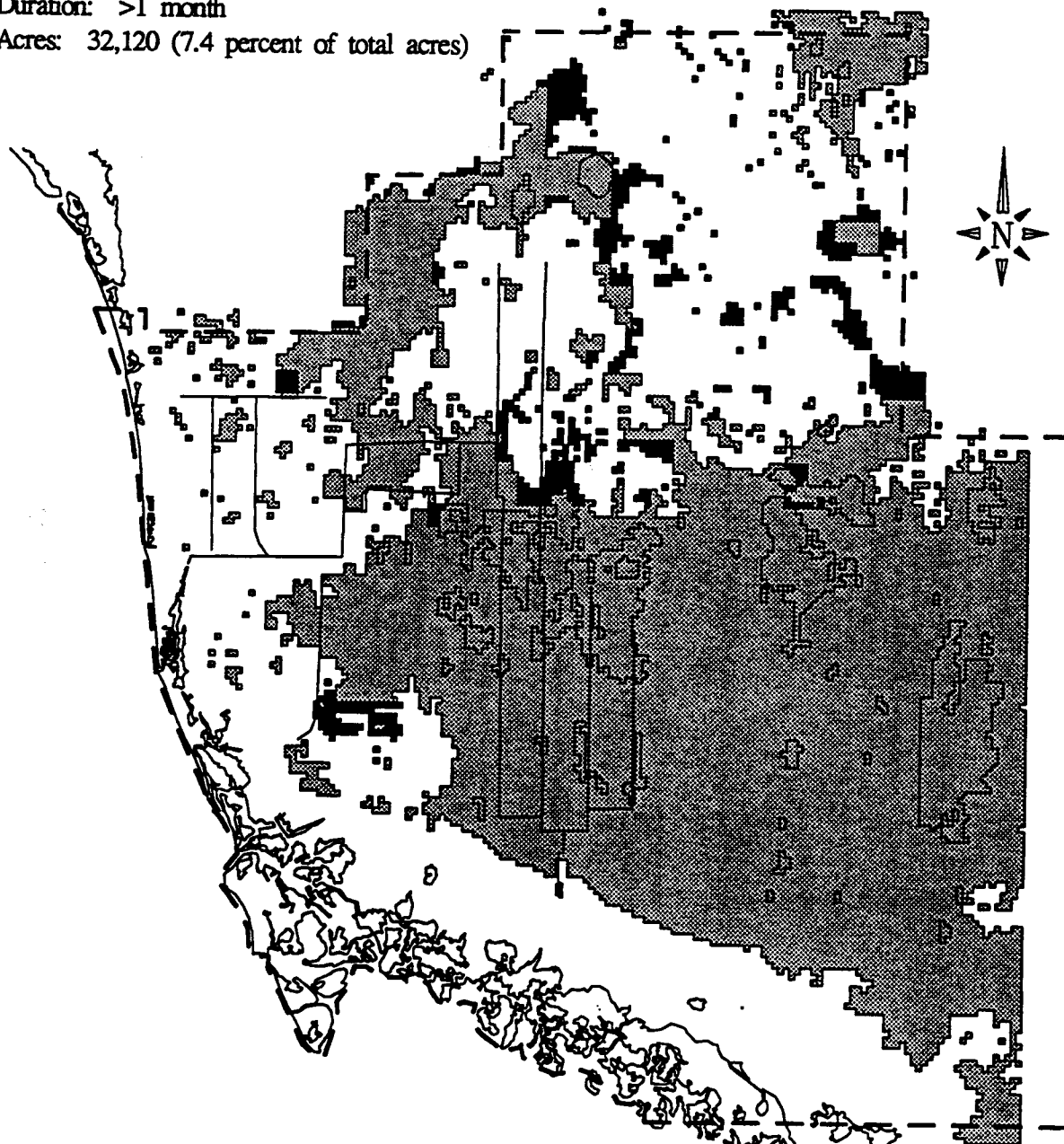
Wetland Areas with Criteria Exceeded

Frequency: 1 in 10 Rain, 2010 Base Case

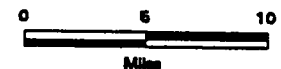
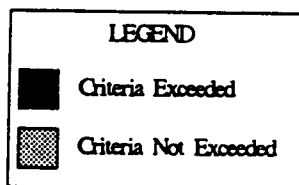
Severity: > 1.0 ft drawdown

Duration: > 1 month

Acres: 32,120 (7.4 percent of total acres)



COLLIER COUNTY MODEL
STUDY AREA



composition name: cwtprae12	
drawn by: pef	date: 01/28/94
revised by:	date:
Planning Dept.	Div. 9050
SOUTH FLORIDA WATER MGMT. DIST.	

FIGURE 3. Collier County Model Wetlands Criteria, 2010 Base Case.

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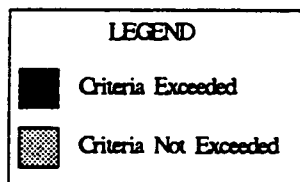
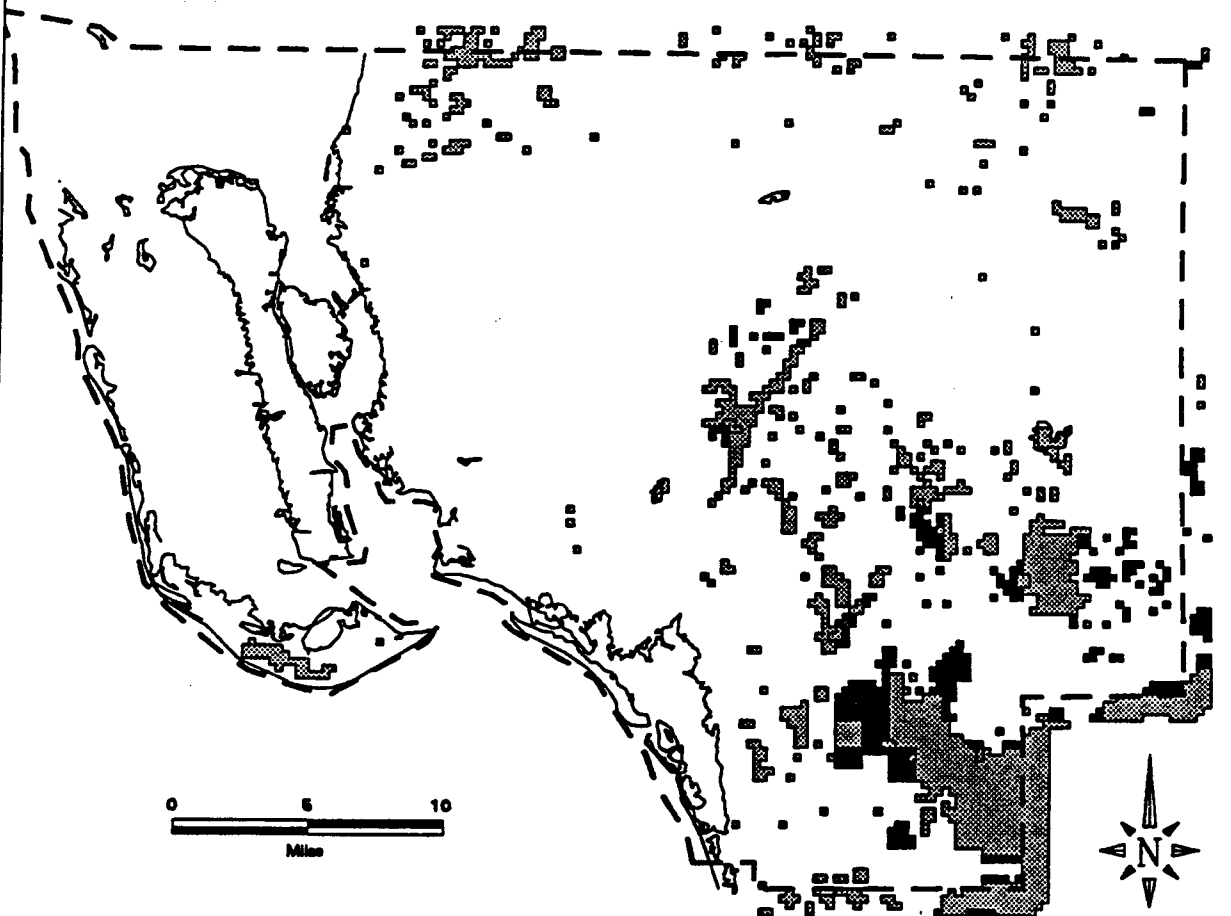
Wetland Areas with Criteria Exceeded

Frequency: 1 in 10 Rain, 1990 Base Case

Severity: \geq 1.0 ft drawdown

Duration: >1 month

Acres: 14,440 (23.1 percent of total acres)



LEE COUNTY MODEL
STUDY AREA



composition name: hontore?	
drawn by: pet	date: 01/28/94
revised by:	date:
Planning Dept.	Div. 9050
SOUTH FLORIDA WATER MGMT. DIST.	

FIGURE 4. Lee County Model Wetlands Criteria, 1990 Base Case.

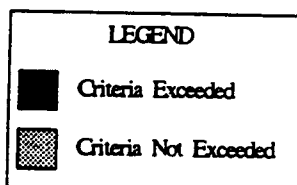
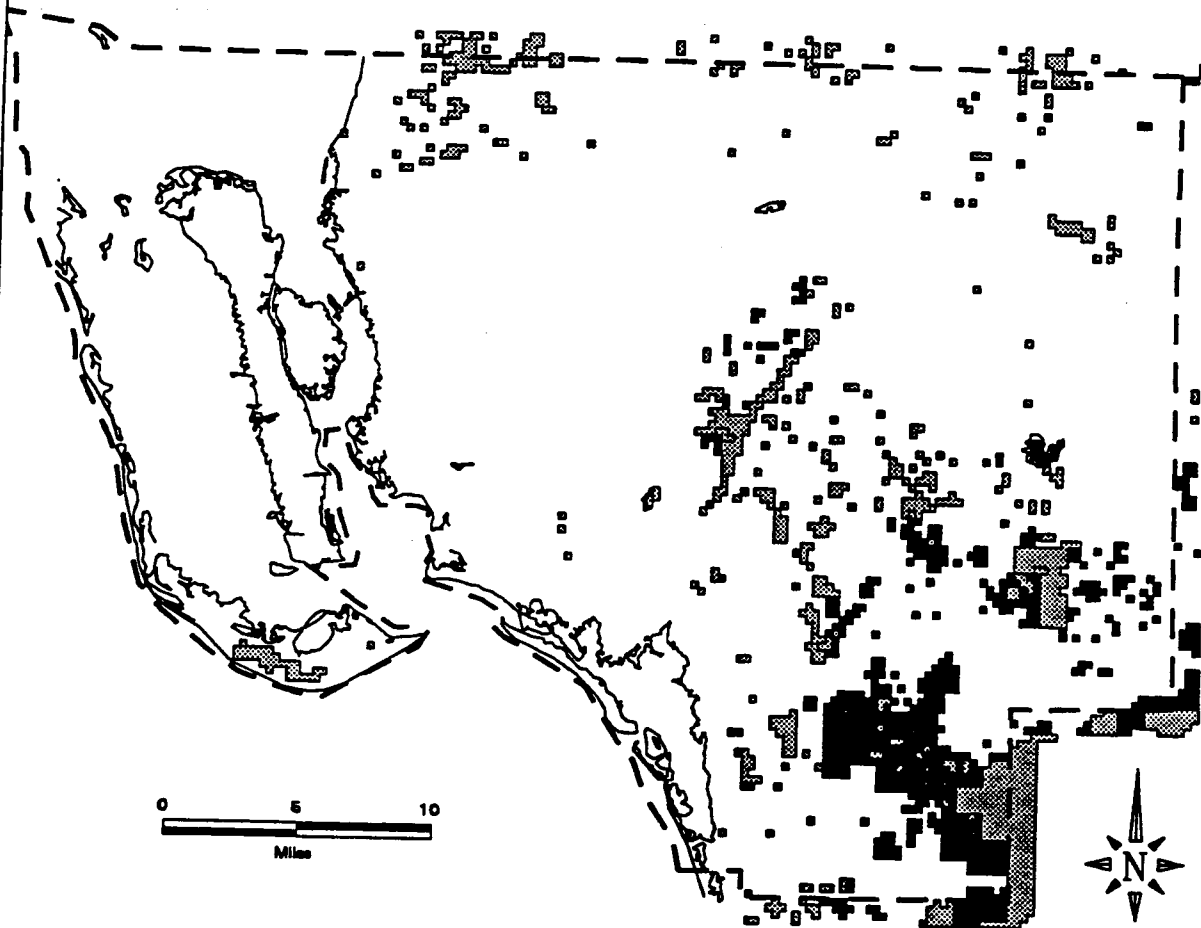
Wetland Areas with Criteria Exceeded

Frequency: 1 in 10 Rain, 2010 Base Case

Severity: ≥ 1.0 ft drawdown

Duration: >1 month

Acres: 30,240 (48.3 percent of total acres)



LEE COUNTY MODEL
STUDY AREA



composition name: hwtored3	
drawn by: pet	date: 01/25/94
revised by:	date:
Planning Dept.	Div. 9050

SOUTH FLORIDA WATER MGMT. DIST.

FIGURE 5. Lee County Model Wetlands Criteria, 2010 Base Case.

Wetland Areas with Criteria Exceeded

Frequency: 1 in 10 Rain, 1990 Base Case

Severity: ≥ 1.0 ft drawdown

Duration: >1 month

Acres: 6,880 (14.3 percent of total acres)

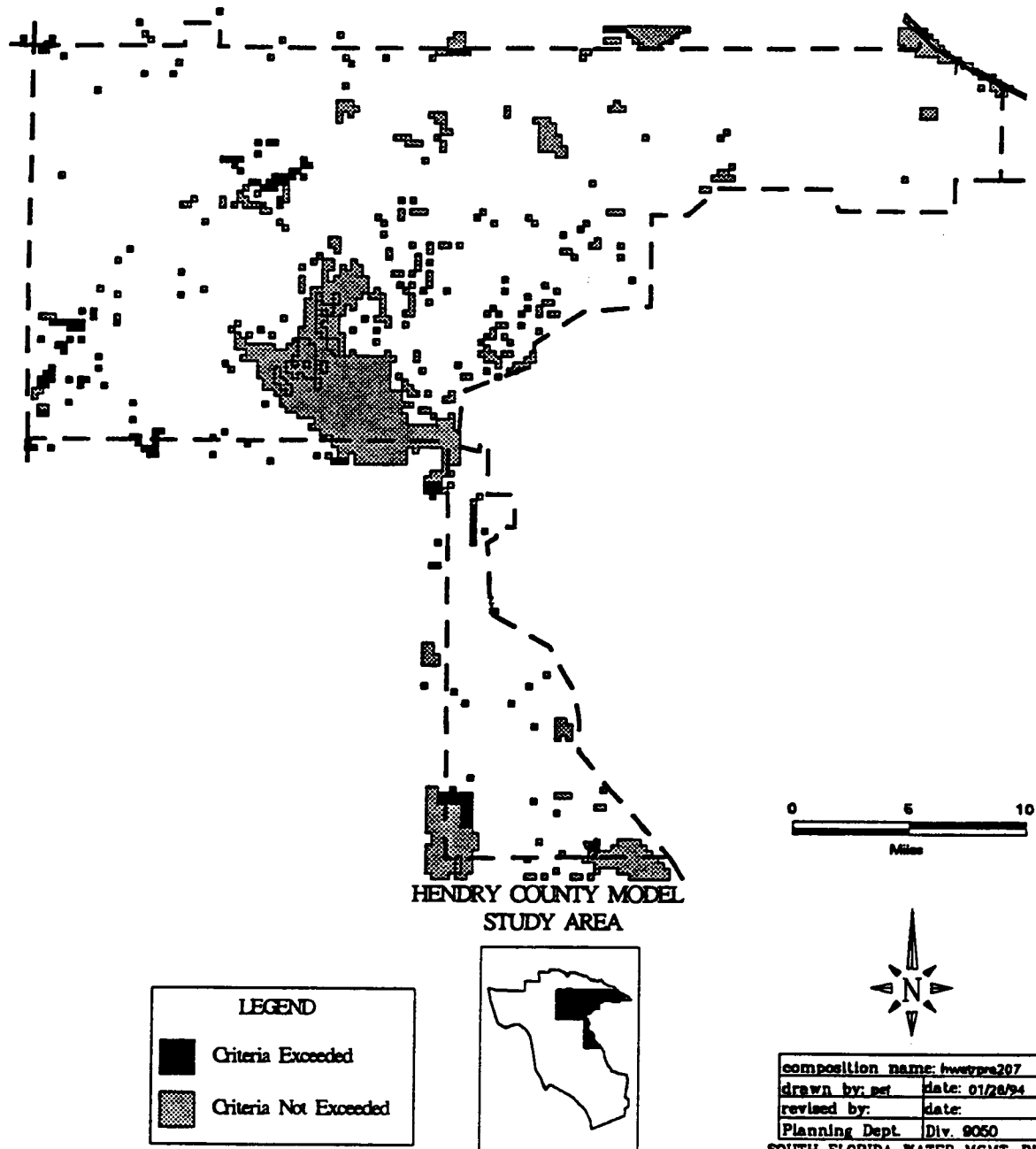


FIGURE 6. Hendry County Model Wetlands Criteria, 1990 Base Case.

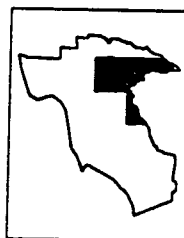
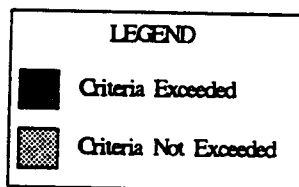
Wetland Areas with Criteria Exceeded

Frequency: 1 in 10 Rain, 2010 Base Case

Severity: ≥ 1.0 ft drawdown

Duration: >1 month

Acres: 7,960 (16.5 percent of total acres)



composition name: hwerpr208	
drawn by: per	date: 01/28/94
revised by:	date:
Planning Dept.	Div. 9050

SOUTH FLORIDA WATER MGMT. DIST.

FIGURE 7. Hendry County Model Wetlands Criteria, 2010 Base Case.

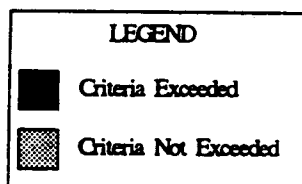
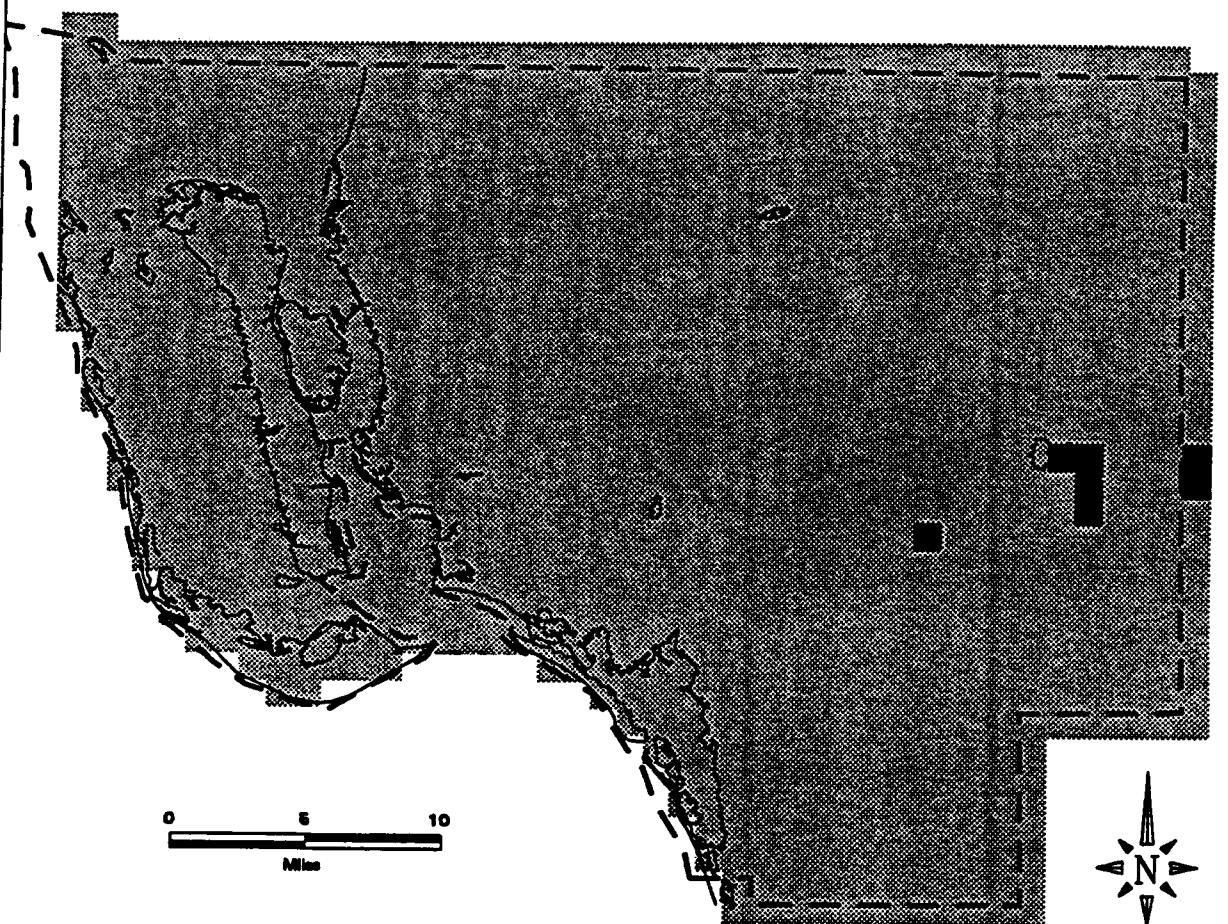
Aquifer Protection

Areas with Criteria Exceeded

Aquifer: Sandstone

Frequency: 1 in 10 Rain, 2010 Base Case

Acres: 4,480 (0.6 percent of total acres)



LEE COUNTY MODEL
STUDY AREA



composition name:	h31p008
drawn by:	pet date: 01/28/94
revised by:	date:
Planning Dept.	Div. 9050

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FIGURE 8. Lee County Model Sandstone Aquifer Protection Criteria, 2010 Base Case.

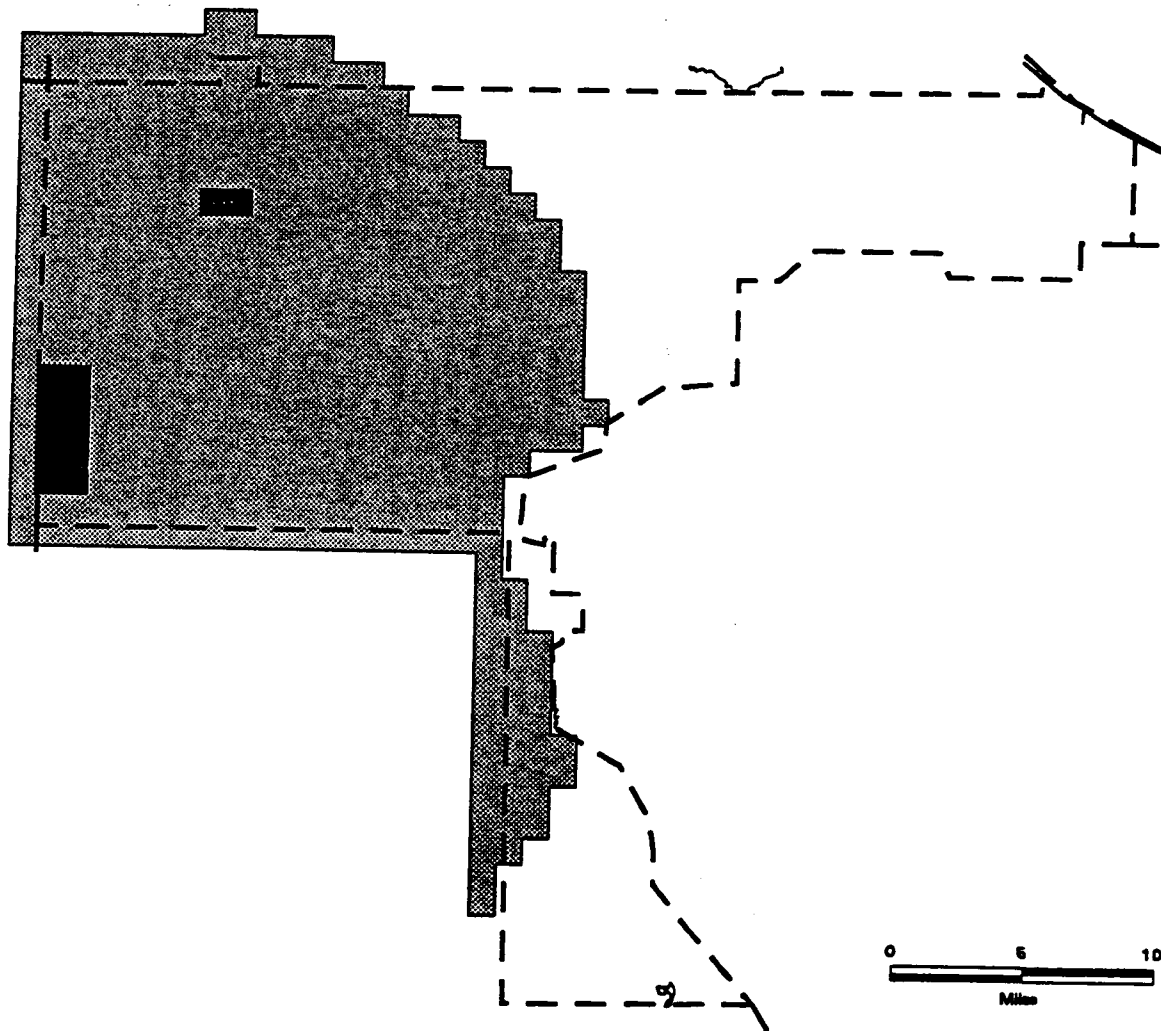
Aquifer Protection

Areas with Criteria Exceeded

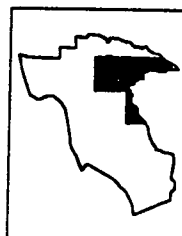
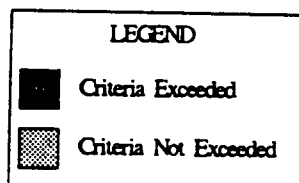
Aquifer: Sandstone

Frequency: 1 in 10 Rain, 2010 Base Case

Acres: 7,680 (2.8 percent of total acres)



HENDRY COUNTY MODEL
STUDY AREA



composition name: hsp3rps206	
drawn by: pet	date: 01/28/94
revised by:	date:
Planning Dept.	Div. 9050

SOUTH FLORIDA WATER MGMT. DIST.

FIGURE 9. Hendry County Model Sandstone Aquifer Protection Criteria, 2010 Base Case.

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Scenario 1

Figures 10 through 13

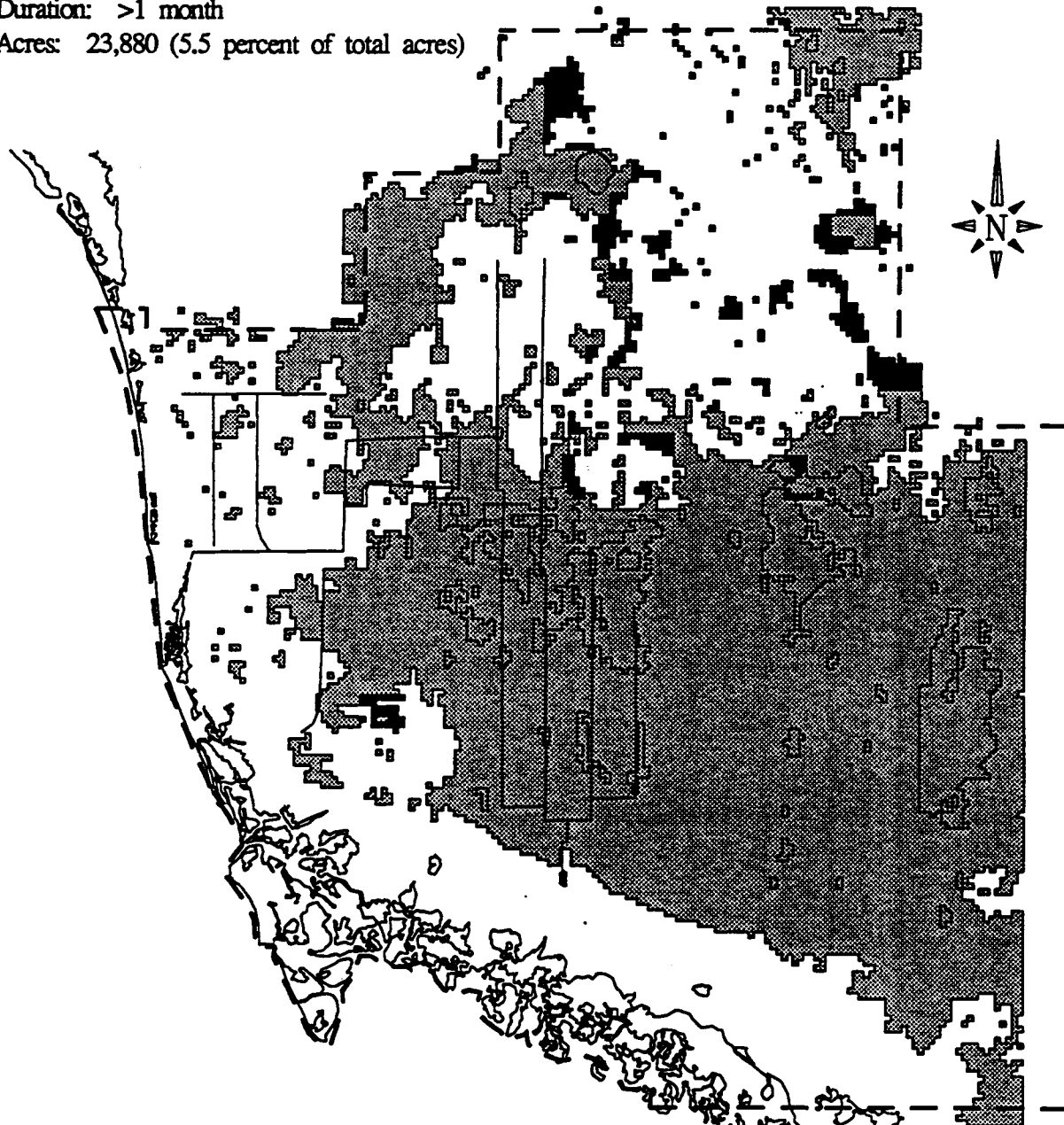
Wetland Areas with Criteria Exceeded

Frequency: 1 in 10 Rain, 2010 Scenario 1a

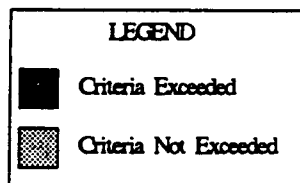
Severity: \geq 1.0 ft drawdown

Duration: >1 month

Acres: 23,880 (5.5 percent of total acres)



COLLIER COUNTY MODEL
STUDY AREA



composition name: CWS00001	
drawn by: psl	date: 01/28/94
revised by:	date:
Planning Dept.	Div. 9050

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FIGURE 10. Collier County Model Wetlands Criteria, 2010 Scenario 1a.

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Wetland Areas with Criteria Exceeded

Frequency: 1 in 10 Rain, 2010 Scenario 1a

Severity: \geq 1.0 ft drawdown

Duration: >1 month

Acres: 12,240 (19.6 percent of total acres)

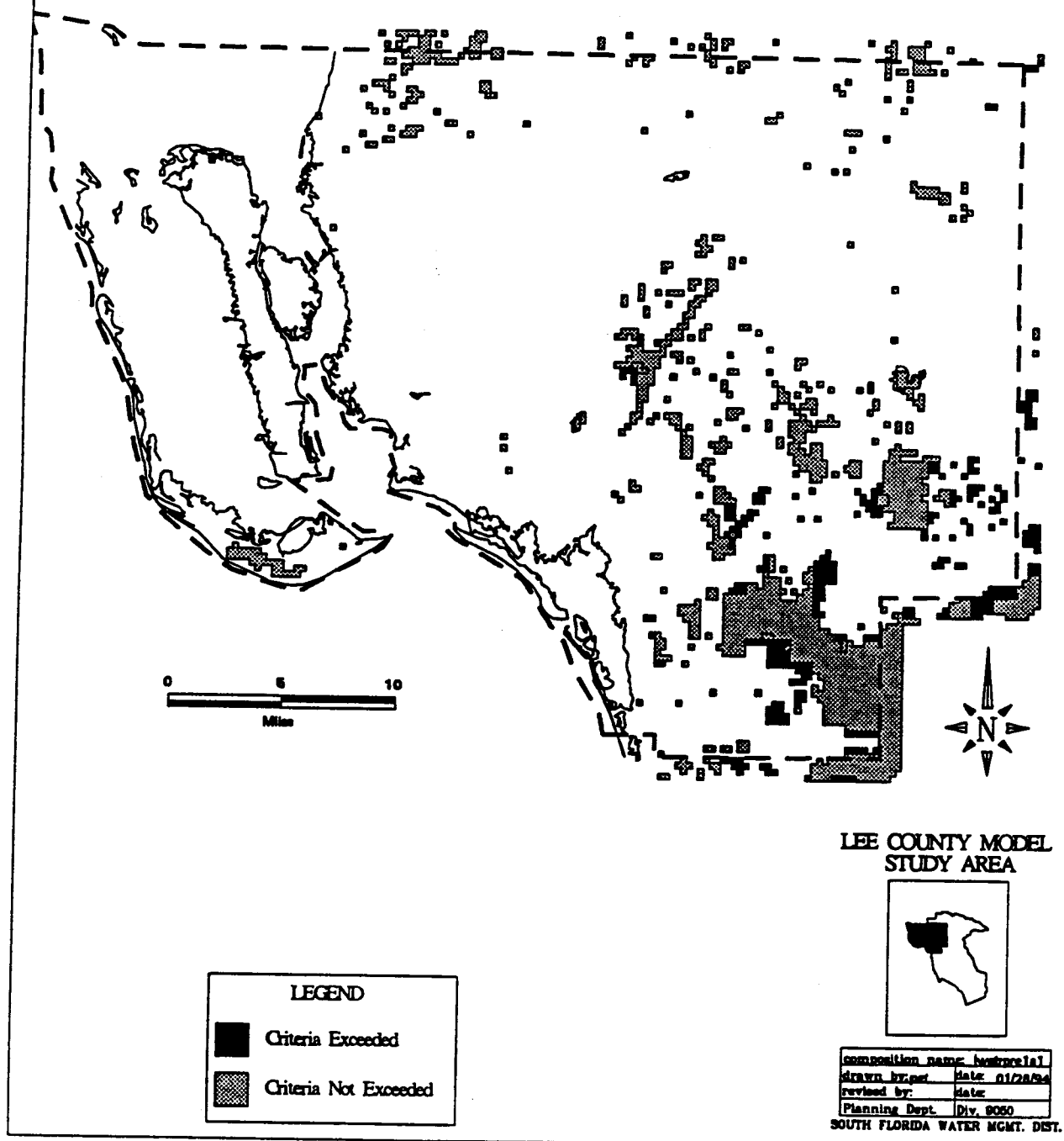


FIGURE 11. Lee County Model Wetlands Criteria, 2010 Scenario 1a.

Wetland Areas with Criteria Exceeded

Frequency: 1 in 10 Rain, 2010 Scenario 1b

Severity: \geq 1.0 ft drawdown

Duration: >1 month

Acres: 28,800 (6.7 percent of total acres)

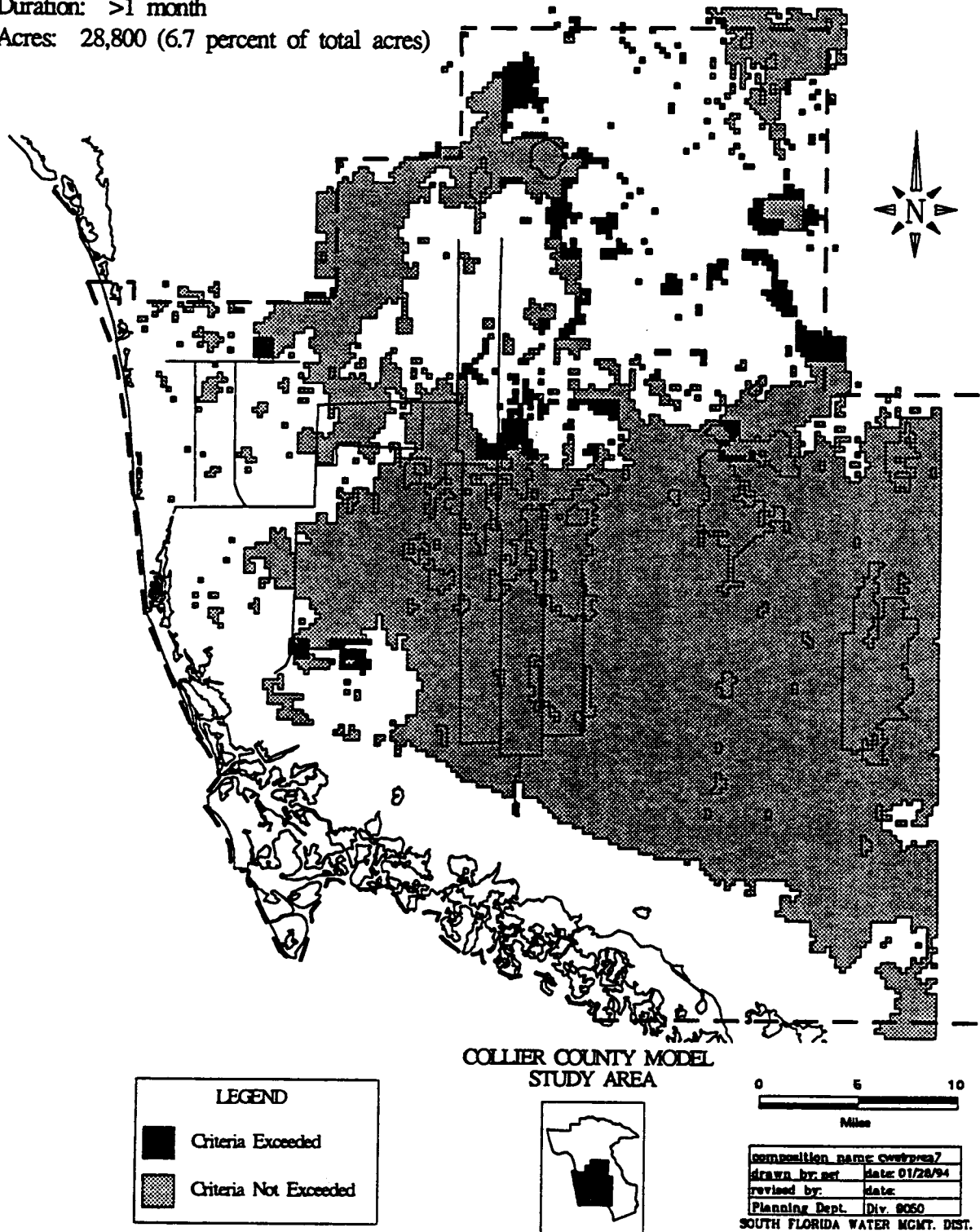


FIGURE 12. Collier County Model Wetlands Criteria, 2010 Scenario 1b.

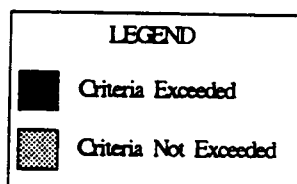
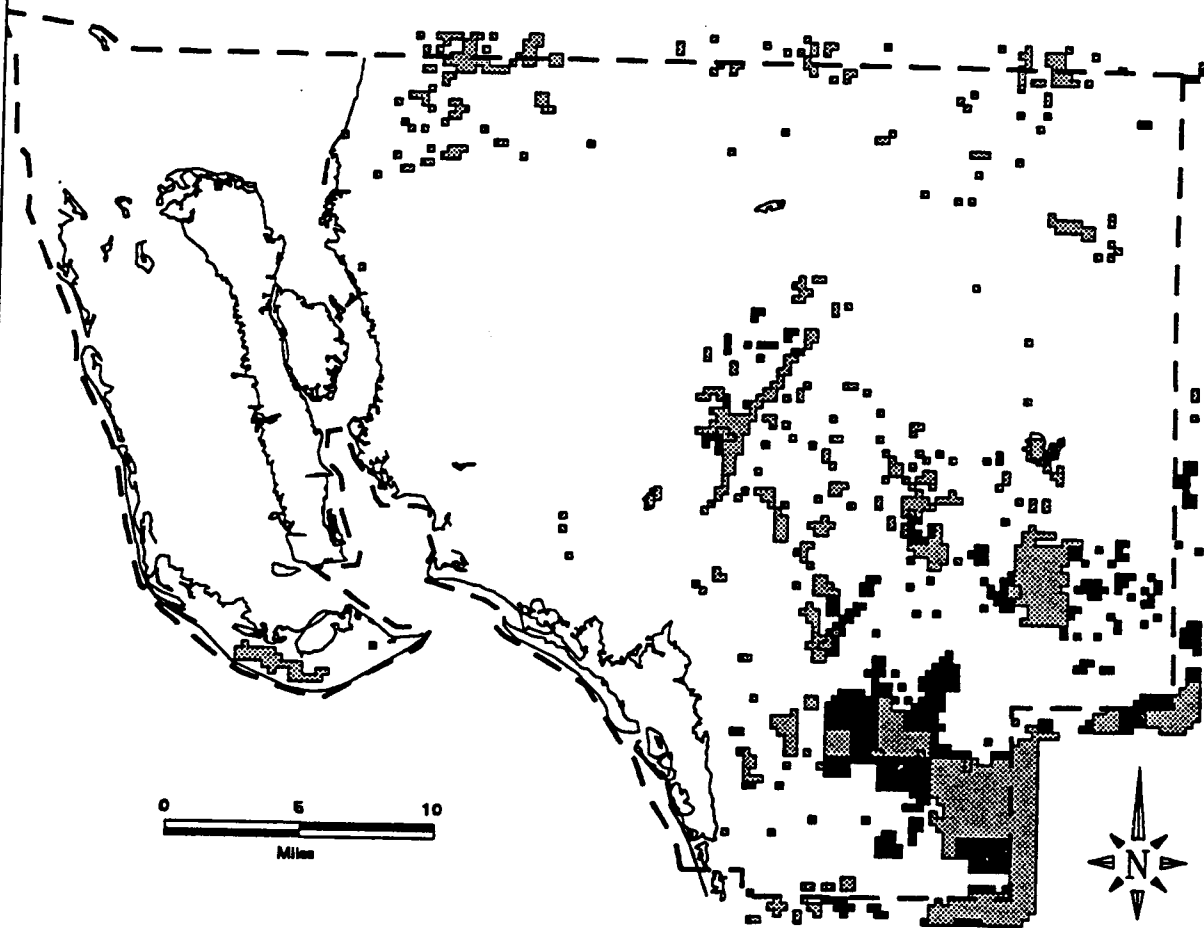
Wetland Areas with Criteria Exceeded

Frequency: 1 in 10 Rain, 2010 Scenario 1b.

Severity: \geq 1.0 ft drawdown

Duration: >1 month

Acres: 20,480 (32.7 percent of total acres)



LEE COUNTY MODEL
STUDY AREA



composition name: hmrp1a2	
drawn by: per	date: 01/28/96
revised by:	date:
Planning Dept.	Div. 9050

SOUTH FLORIDA WATER MGMT. DIST.

FIGURE 13. Lee County Model Wetlands Criteria, 2010 Scenario 1b.

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Scenario 2

Figures 14 through 15

Wetland Areas with Criteria Exceeded

Frequency: 1 in 10 Rain, 2010 Scenario 2c

Severity: \geq 1.0 ft drawdown

Duration: >1 month

Acres: 28,560 (6.6 percent of total acres)

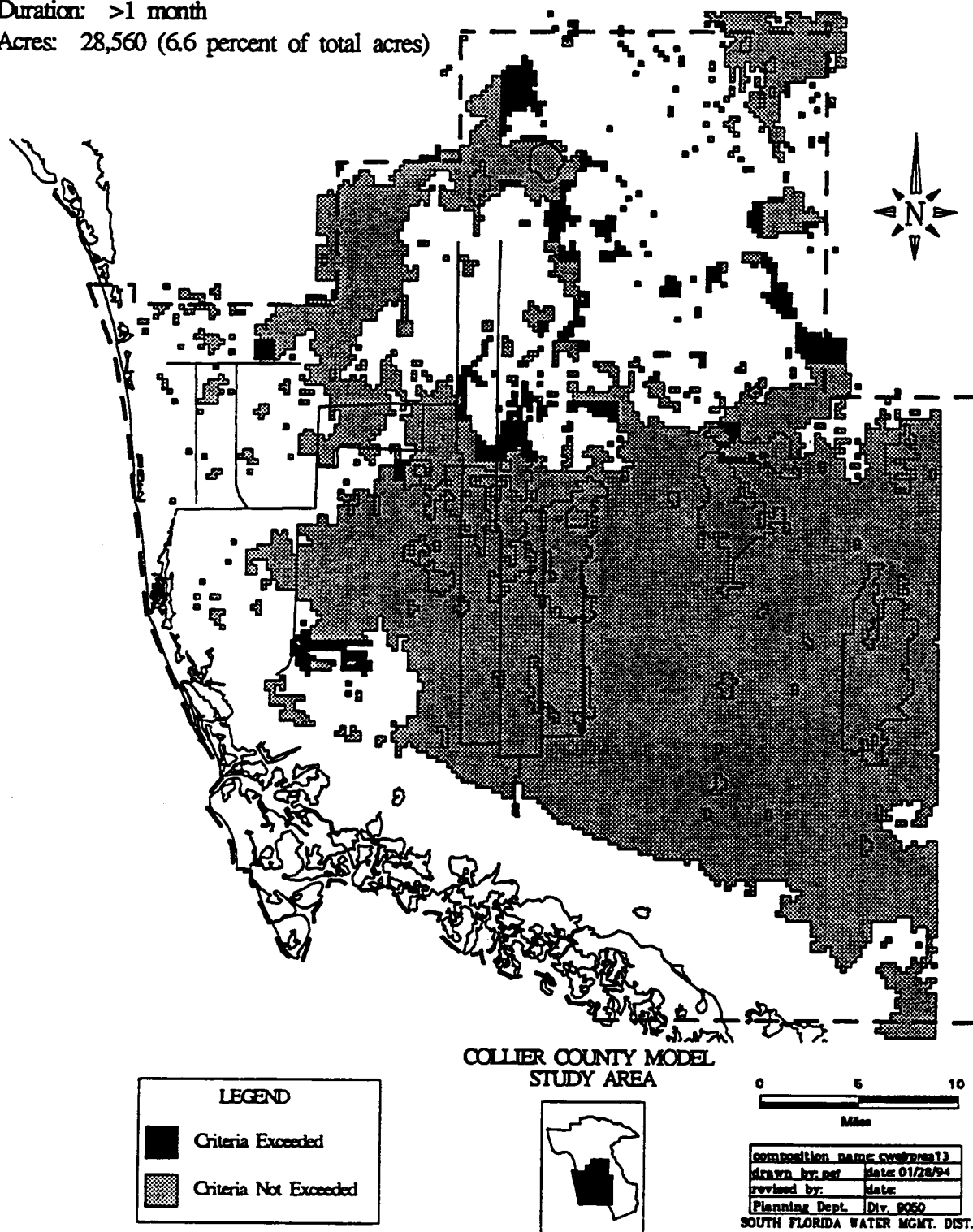


FIGURE 14. Collier County Model Wetlands Criteria, 2010 Scenario 2c.

Wetland Areas with Criteria Exceeded

Frequency: 1 in 10 Rain, 2010 Scenario 2c

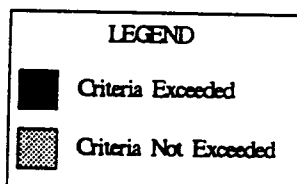
Severity: \geq 1.0 ft drawdown

Duration: >1 month

Acres: 28,120 (44.9 percent of total acres)



LEE COUNTY MODEL
STUDY AREA



composition name: hmtoc1e6	
drawn by: per	date: 01/28/94
revised by:	date:
Planning Dept.	Div. 9050
SOUTH FLORIDA WATER MGMT. DIST.	

FIGURE 15. Lee County Model Wetlands Criteria, 2010 Scenario 2c.

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SUMMARY OF MODELING RESULTS

The base case model runs indicated that there were problems in meeting the wetland protection criterion as well as the seawater intrusion protection criterion at both the 1990 permitted demand level and at the 2010 projected demand level. Wetland problem areas occurred in Lee County and in the modeled portions of Collier and Hendry counties. Problems in meeting the seawater intrusion criterion occurred in both the lower Tamiami aquifer and the water table aquifer of both Collier and Lee counties. The general aquifer protection criterion was met with the exception of small areas of the Sandstone aquifer layer of eastern Lee and western Hendry counties.

Eleven different alternative modeling scenarios or combination scenarios were simulated to help reduce problems in meeting the resource protection criteria. These included 7 individual modeling scenarios (1a, 1b, 2a, 2b, 2c, 3, and 4) and 4 combination modeling scenarios (5a, 5b, 6a, and 6b). All 11 scenarios were simulated for Collier County. Modeling scenario 4 was only applicable to Collier County; however, the remaining 10 scenarios were simulated for Lee County. Only the scenarios involving agricultural efficiency (2a, 2b, and 2c) were simulated for Hendry County. Scenarios 1a, 1b, and 3 involved public water supply demands and reclaimed water, neither of which are very large in Hendry County. Alternatives 5a, 5b, 6a, and 6b involved combinations with scenarios 1a, 1b, and 3; thus, they were also not simulated for Hendry County.

Effectiveness for the Wetland Protection Criterion

Figures 16 through 19 present a summary of the modeling results pertaining to the wetland protection criterion in the modeled portion of the LWC Planning Area and in Collier, Lee, and Hendry counties. All of the modeling scenarios produced reductions in wetland problem areas in Collier and Lee counties. Only modeling scenarios 2a, 2b, and 2c were simulated for Hendry County; these scenarios did not cause any reduction in wetland problem areas in Hendry County.

The combination modeling scenarios (5a, 5b, 6a, and 6b) were, in general, more effective than the individual modeling scenarios (1a, 1b, 2a, 2b, 2c, 3, and 4) in reducing wetland problem areas. Scenario 6a was the most effective modeling scenario in reducing the total area of wetlands not meeting the wetland protection criterion in both Collier and Lee counties (reductions of 39 percent in Collier County and 70 percent in Lee County compared to their respective 2010 base case runs).

The individual modeling scenarios involving removal of public water supply demands from the shallow aquifers (scenarios 1a and 1b) were more effective in helping to meet the wetland protection criterion than the individual modeling scenarios involving agricultural efficiency (scenarios 2a and 2b) or involving reclaimed water (scenario 3).

Lower West Coast Planning Document

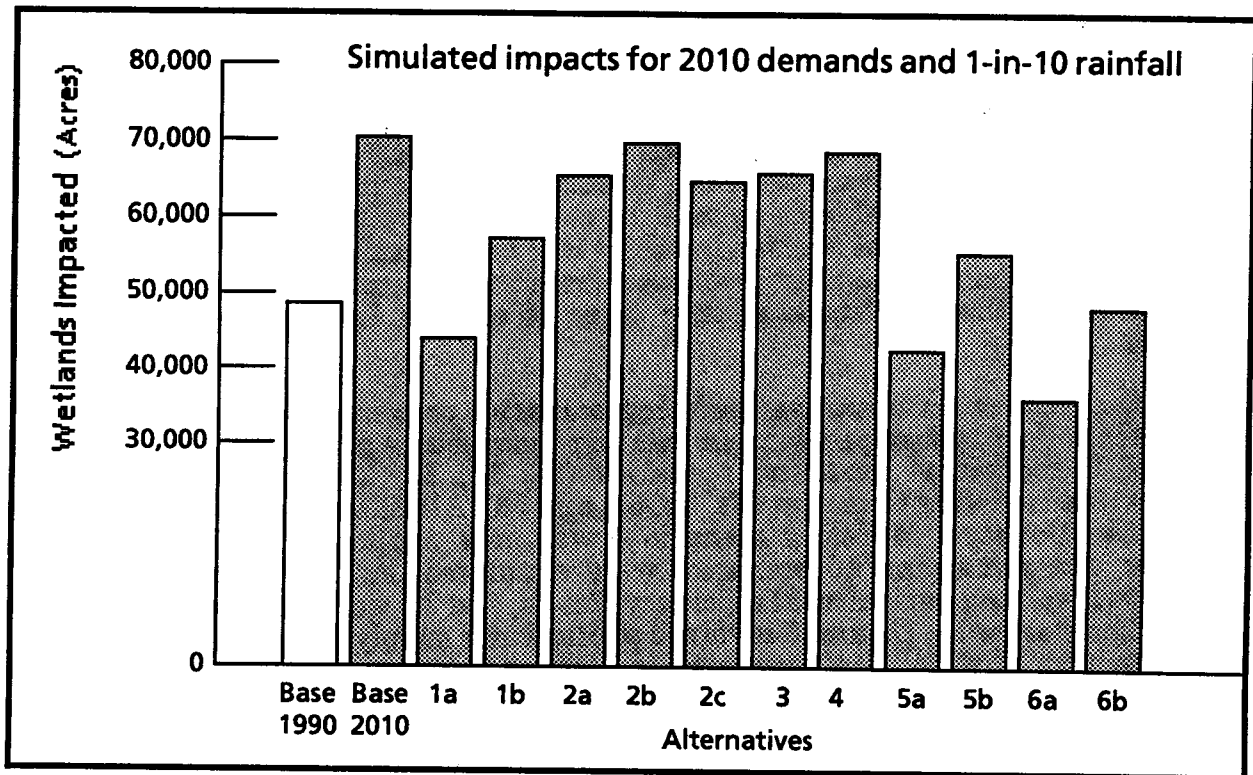


FIGURE 16. Effects of alternatives on simulated wetland impacts in the Lower West Coast Planning Area.

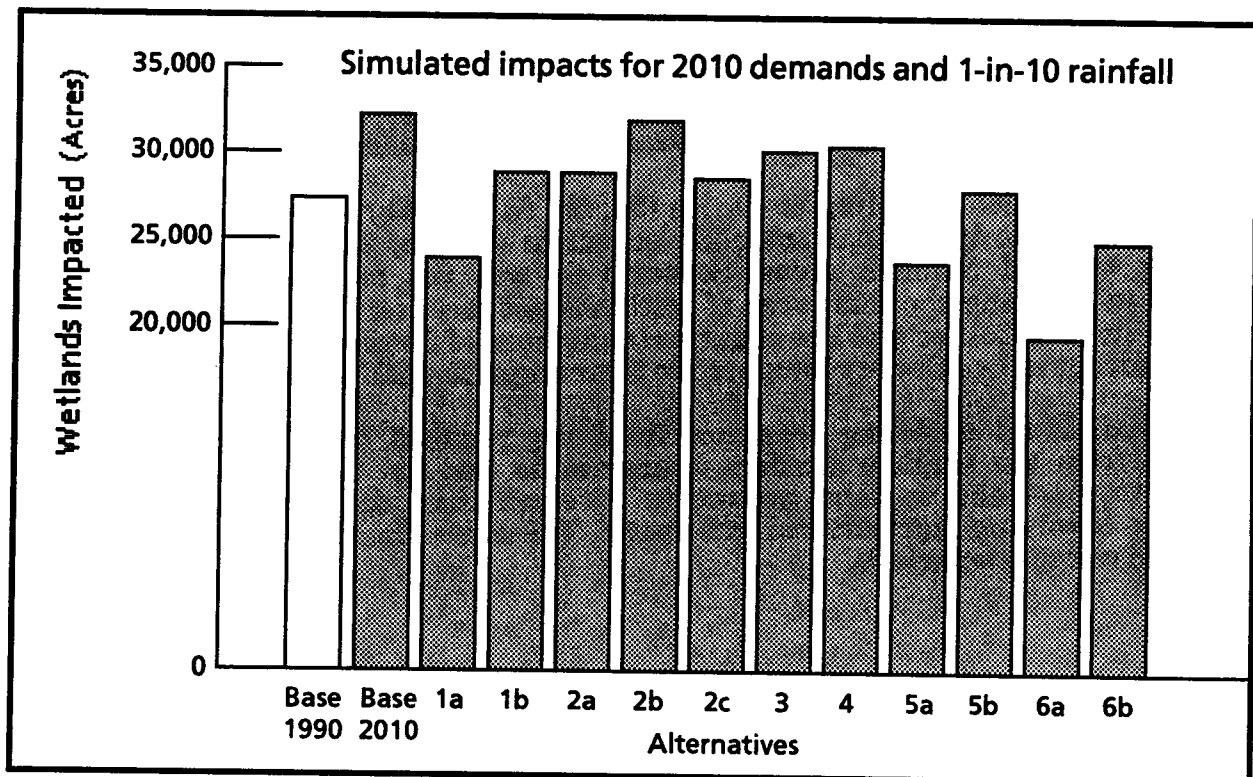


FIGURE 17. Effects of alternatives on simulated wetland impacts in the Collier County Area.

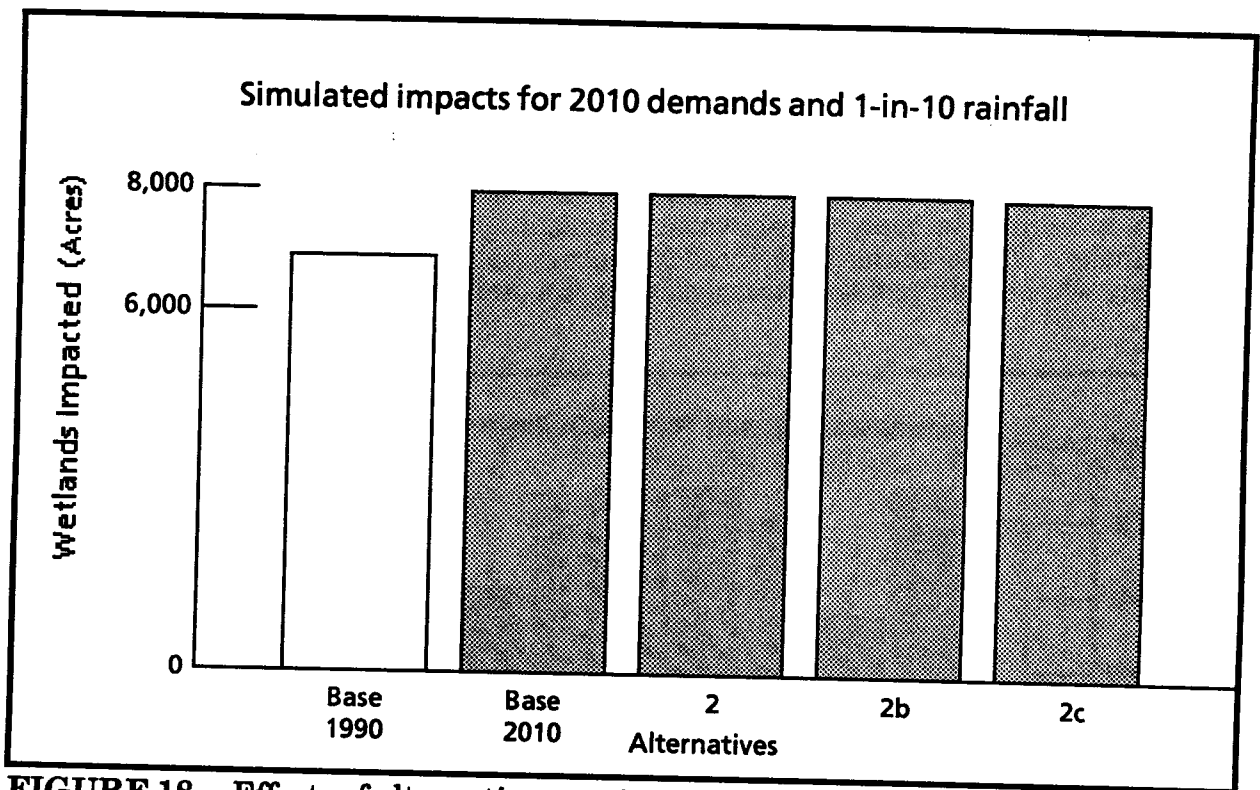


FIGURE 18. Effects of alternatives on simulated wetland impacts in the Hendry County Area.

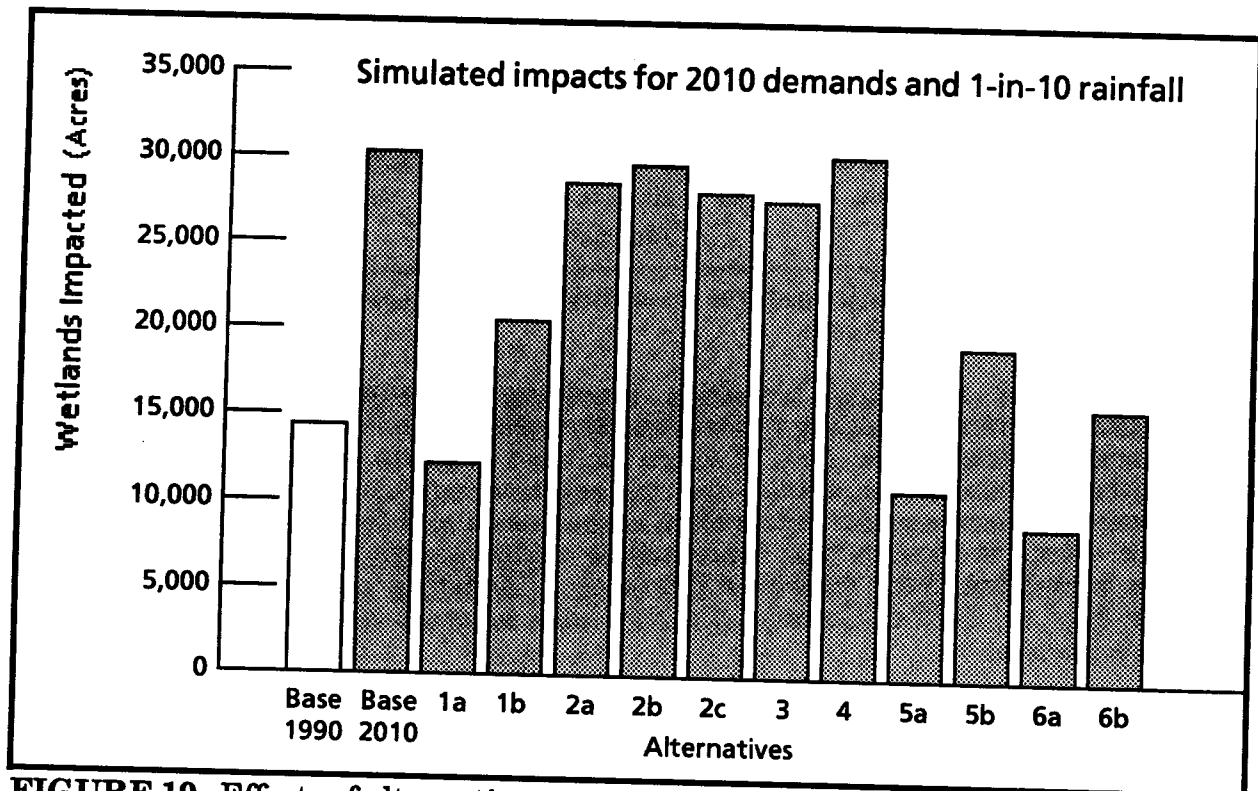


FIGURE 19. Effects of alternatives on simulated wetland impacts in Lee County.

Effectiveness for the Seawater Intrusion Protection Criterion

Figure 20 presents a summary of the modeling results pertaining to the seawater intrusion protection criterion in Collier and Lee counties. In general, the individual modeling scenarios involving both the removal of public water supply demands from the shallow aquifers (scenarios 1a and 1b) and reclaimed water (scenario 3) were effective in helping to meet the seawater intrusion protection criterion in Collier and Lee counties. These same individual modeling scenarios were even more effective when they were combined as scenarios 5a, 5b, 6a, and 6b.

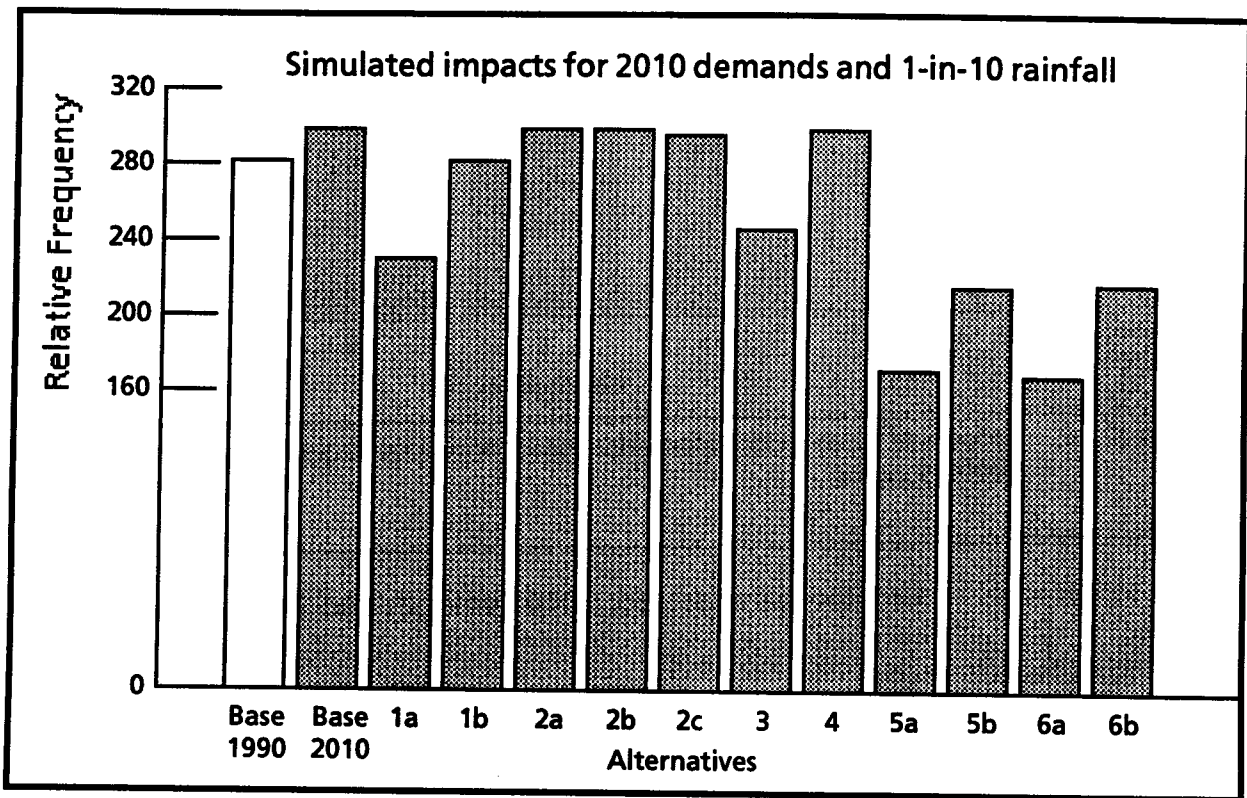


FIGURE 20. Effects of alternatives on simulated seawater intrusion in the LWC Planning Area.

The individual modeling scenarios involving agricultural efficiency were generally not effective in helping to meet the seawater intrusion protection criterion; however, scenarios 6a and 6b, both of which included scenario 2c (increased efficiency for both citrus and small vegetables) met the seawater intrusion protection criterion for the lower Tamiami aquifer better than scenarios 5a and 5b which did not include scenario 2c. Thus, it appears that increased agricultural efficiency would contribute to greater protection from seawater intrusion. Modeling scenario 4, which was applicable only to Collier County, did not help to meet the seawater intrusion protection criterion.

Effectiveness for the General Aquifer Protection Criterion

The general aquifer protection criterion had been completely met in the base case model simulations for Collier County, and so no simulations were not needed to achieve compliance with the general aquifer protection criterion in Collier County.

Only a few cells in the layer representing the Sandstone aquifer of eastern Lee County and western Hendry County had failed to meet the general aquifer protection criterion. Scenario 1a, 5a, 6a, and 6b caused small improvements in meeting the general aquifer protection criterion for the Sandstone aquifer layer in Lee County. Scenarios 2a, 2b, and 2c did not help to meet the general aquifer protection criterion for the Sandstone aquifer in Hendry County.

DISCUSSION OF MODELING RESULTS

None of the individual modeling scenarios (1a, 1b, 2a, 2b, 2c, 3, and 4) nor the combination modeling scenarios were successful in eliminating all problems in meeting the resource protection criteria in the modeled portion of the LWC Planning Area. However, the modeling results showed that all of the scenarios, either individually or in combination with other scenarios, did help to meet one or more of the resource protection criteria. The fact that some individual modeling scenarios, when evaluated in isolation from other scenarios, did not appear to help meet criteria should not be construed as evidence that the measures these scenarios represent are ineffective. Rather, the fact that these same individual scenarios did help to meet criteria when combined with other scenarios should be cited as evidence that the measures represented by all of the scenarios would be helpful in meeting the resource protection criteria.

The application of the regional models suggests that unless new approaches are taken, it may not be possible to support the projected growth to the year 2010 while maintaining the proposed level of resource protection. Furthermore, the problem areas identified do not necessarily begin in the year 2010. Many of the same areas failed to meet protection criteria for the 1990 permitted demand level, indicating existing problems or their onset by the time the permits issued through the year 1990 reach their full demand. Some of the problems occurred during both a 1-in-10 drought as well as during average rainfall conditions, indicating chronic problems. It should be noted, however, that all of the scenarios simulated were more effective during average rainfall conditions than a 1-in-10 drought condition. The following chapter of the plan identifies recommendations designed to address the issues identified by ground water modeling.

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